General Observations of Post-Cerro Grande Fire Water Quality

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Water Quality and Hydrology Group (ESH-18)

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The Laboratory's Stormwater Team had collected a total of 45 post-fire stormwater samples by the middle of August. Each storm will be evaluated in-depth once all data are finalized and validated. This summary is intended to highlight any highly unusual results or common themes in the partial water quality results available at the end of August. Our knowledge is evolving and some of these general observations may change with later storm events. The water quality seen during any storm can vary widely depending on the size of the flood and the contaminant history at a given location. Runoff samples have high turbidity and pose special analysis and interpretation problems. However, to date we have some information from both large and small runoff events and we can start to explore the possible range of results that may be seen in the future. In the end, the multi-agency Flood Risk Assessment Team (FRAT) separately will evaluate the collective risks posed by fire and Laboratory contaminants.

Radioactivity

- For small runoff events, the overall levels of total (gross) alpha and beta radiation levels appear to be comparable to pre-fire data. Laboratory impacts are apparent in some of the samples, but these were seen before the fire.
- With the larger runoff events, significant changes in the quality of the runoff are noted. All of the significant changes observed to now are related to the fire and are seen both above and on the Laboratory.
- The large events often drain the heavily burned areas and carry large quantities of sediment and black ash; in a filled stormwater sample container, 25 percent or more of the volume is sediment.
- The levels of the radioactive substances actually dissolved in the water are comparable to or possibly slightly elevated above pre-fire levels in runoff. Dissolved gross alpha and beta levels typically are below EPA Maximum Contaminant Limits (MCLs) for community drinking water systems.
- We find that almost all (90 percent or so) of the radioactivity in an unfiltered stormwater sample (large event) is associated with the sediment and ash carried by the flood flows. The main sources of the radioactivity are naturally-occurring radioactive substances in the sediment and ash, such as potassium-40, radon, and uranium. In addition, the sediment carries other radioactive fallout particles that were dispersed worldwide after above-ground nuclear testing in the 1950s and 60s. With added sediment levels in the runoff after the fire, due to the very erosive nature of the burned areas, there is a corresponding increase in the quantity of naturally present radioactivity being moved into the stream channels draining the burned areas.
- The initial sample results indicate that the concentrations of some of the fallout radionuclides in sediments are higher after the fire. Cesium-137 concentrations in the suspended material are 5 – 20 times pre-fire levels, plutonium 5 – 10 times, and

strontium-90 concentrations are elevated by 2 to 5 times. The results suggest that fire caused the transfer of part of these radionuclides bound to the forest canopy or in the forest litter and concentrated it in the ashy layer of the burned surface soil. This phenomenon has been observed elsewhere and reported in the scientific literature. The post-fire concentrations of Cs-137 and Sr-90 occasionally exceed screening action levels for residential use and will need to be further evaluated for long-term exposure risks.

Metals

Our evaluation of metals data is in an early phase. Preliminary analysis indicates that dissolved metals concentrations are generally below EPA MCLs for drinking water. Several dissolved metals, however, exceed Laboratory ER Ecological Screening Levels. These will have to be examined further by the FRAT.

Cyanide

High levels of cyanide have been detected in water and sediment samples taken from several canyons that drain burned areas. Cyanide is toxic to aquatic biota and wildlife. The highest concentrations have been found in ash-ladened runoff waters both above and across the Laboratory. Cyanide (amenable) levels as great as 5 times those that are lethal to fish were measured. No reports of fish kills in the Rio Grande have been received, however. The most recent data from these canyons show toxic levels in stormwater as of July 29, suggesting that this potential problem may persist. The source of the cyanide is likely the fire retardants. Some of the fire retardants contain cyanide compounds such as potassium ferrocyanide, which is added as an anti-caking additive and as a corrosion inhibitor to protect the tanks on the slurry bombers.

High Explosives

No high explosives have been detected in the preliminary runoff analyses. The initial unvalidated results from the first large runoff event (June 28) identified numerous HE compounds in samples taken both above and on the Laboratory. A QA review of those results, however, showed that the ash in the samples interfered with the normally-precise analytical technique, and the data were believed to be suspect. No HE compounds were detected in re-analyses of the same water samples using an alternate method that is not affected by ash content.

Some Chemicals that Bio-accumulate

Preliminary measurements show less than detectable levels of mercury, dioxins and furans, benzo(a)pyrene, hexachlorobenzene, and Polychlorinated Biphenyls (PCBs) in stormwater. These are substances that that can build up in the food chain to levels that are harmful to human and ecosystem health, and thus pose special long-term concerns.